Affordable Excellence in Home Theater, Stereo, Film and Music

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Sounding Board

Definitive Technology's Sandy Gross on Loudspeaker Design

The Case for Bipolar Loudspeakers with Built-in Subwoofers

Chris Martens recently reviewed the Definitive Technology BP7001SC Bipolar SuperTower for The Absolute Sound (Issue146). During the review process, I discussed with him at some length two of Definitive's signature technologies, specifically bipolar radiation and built-in powered subwoofers. Chris believed these concepts would be of general interest to AVguide Monthly readers, and asked me to write a short piece describing them (without, of course, turning the article into a 2-page ad for my company).

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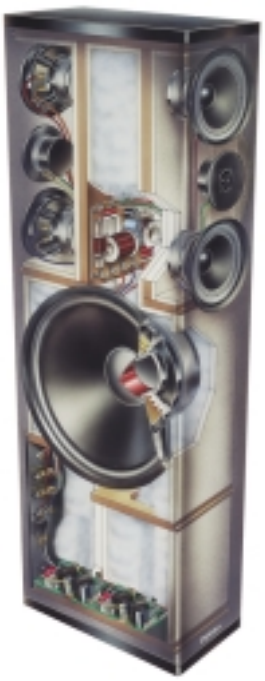
I have always liked speakers with unconventional radiation (i.e., non-forward-radiating) patterns. The first true audiophile loudspeaker I owned was the KLH 9 full-range electrostatic. This was in 1972. These speakers had a "you are there" imaging presence and boxless sound quality I had never heard before. There were many reasons for this, but an important key to their performance was the fact that they radiated sound both forward and rearward.

To me, imaging is the real magic in a loudspeaker's performance. All the conventional parameters of a loudspeaker's performance (linear wide frequency response, low distortion, excellent transient response, etc.) are important, but imaging is that elusive quality that brings the musicians into the room or brings you into the concert hall or into the movie. Imaging allows the suspension of disbelief and lets you imagine that what you are listening to is real. The KLH electrostats were wonderful in this regard.

Full-range electrostatic panels of that day, including the KLH, however, had many shortcomings, including very high price, large size, difficult power requirements (I used a set of Futterman output transformer-less vacuum tube amplifiers, which did a better job than most with problematic electrostatic speaker loads), limited dynamic range, limited bass performance, positioning difficulties, etc. It seemed to me that it would be fantastic to create a loudspeaker that brought the benefits of these exotic, impractical panels into a product that made sense for the majority of listeners in the real world.

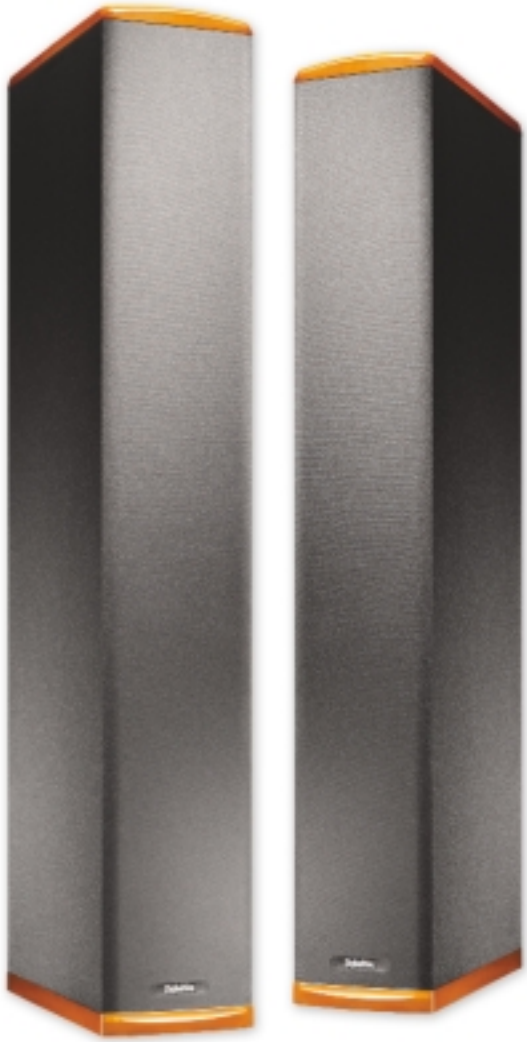
I designed my first bipolar loudspeaker in 1973 or 1974, a narrow-format tower incorporating multiple small-diameter bass/midrange drivers arrayed on both the front and rear baffles along with piezoelectric tweeters and passive radiators. It was quite successful in the marketplace. It also brought me a phone call from the great loudspeaker designer Jon Dahlquist (who was also introducing a loudspeaker with a piezoelectric tweeter—the soon-to-be-famous, time-aligned Dahlquist DQ 10, which was known for its "boxless" sound) and led to a long and enjoyable friendship between myself and Jon, as well as with his partner, the late Saul Marantz. (Marantz not only founded the company which still bears his name, but was the creator of a number of classic high end audio components; he also recognized and helped cultivate design talent in others—including Jon Dahlquist and tuner-wizard Dick Sequerra.)



Cross Section of the Original BP2000 Sounding Board

When my partners, Don Givogue and Ed Blais, and I started Definitive in 1990, our first product, the BP10 loudspeaker, was also a narrow tower with basically two complete full-range driver arrays. One faced forward and the other rearward. This is the basic concept of a bipolar speaker. The two driver arrays radiate sound (in phase with one another) in what is basically an omnidirectional pattern, exactly as sound is radiated in real life from an original sonic event. This technology provides a lifelike balance of early-arrival sound information, which provides focus, clarity, and location data. This combines with properly delayed complex and somewhat random late-arrival ambient information (just like the ambience of an instrument in a concert hall), which conveys the lush, natural three-dimensional soundstage of a live musical performance or cinematically portrayed event. These effects very much help to make the walls of the listening room disappear and expand the apparent size of the listening room into something that more closely approximates the sound-space in which the live event took place. Listeners I've spoken with consistently find that the difference bipolar technology makes is dramatic, involving, and quite captivating.

There is another benefit of bipolar technology, which is not as important to me as a critical listener but has been praised by many reviewers and listeners. Because a bipolar loudspeaker closely approximates an omnidirectional sound source, it does a better job of delivering superior sound throughout the room for all listeners in that room. In effect, the "sweet spot" is greatly expanded—a real-world benefit for listeners who tend to move around the room or who share their music listening or movie experiences with friends and family.



BP7000SC (left) and BP7001SC (right) SuperTowers

Now let me talk a little about built-in powered subwoofers. Definitive was the first company to introduce the concept of built-in powered subwoofers to the marketplace—technology that first appeared in the BP2000 loudspeaker we released several years ago. Interestingly, our concept grew out of our search for better-quality audiophile/music reproduction—not out of a search for a place to "hide" the subwoofer in a home theater system. Our belief was (and still is) that there are significant advantages (especially for the subtleties of music reproduction) in having dual stereo subwoofers that have been specifically engineered to blend ideally with the rest of the speaker system. In addition, two subwoofers are really a lot more powerful than one. By locating the subwoofer(s) at the same position as the rest of the speaker system(s), you also eliminate the inconsistencies related to variable placement of the subwoofer(s) in the room. We also believe that there are sonic advantages to stereo subwoofers beyond the obvious ones of better coupling to the room and more linear response (itself owing to better spreading out of the excitation of the room's eigenmodes). For example, you can engineer the subwoofer as an integral part of a true full-range system, as we do in the Definitive "SuperTowers," rather than designing a general-purpose subwoofer that has to be adaptable for use with a variety of other systems. We design our speakers to take full advantage of the fact that they incorporate built-in subwoofers by further optimizing the performance of the rest of the system (which no longer has to handle the mid- and low-bass frequencies covered by the subwoofers) and by properly integrating the subwoofers into the system. This level of integration is very difficult to achieve with a single stand-alone subwoofer (since it is tricky to get one subwoofer to blend equally well with multiple satellite speakers that are placed several feet apart). In practice, the subwoofer-within-main-speaker idea has really caught on with the public, though I think some customers probably value the idea as much because it eliminates an extra subwoofer box or two as for the better sound quality it affords. But I really do want to stress that, when properly utilized, building a powered subwoofer into the speaker allows you to optimize many other aspects of the speaker's design, and the resulting performance (at least in the case of Definitive) is clearly superior for both music and home theater. Not surprisingly, when the Dolby folks introduced Dolby Digital, they demonstrated the then-new system with a separate subwoofer for every channel and still recommend this approach for top performance.

Interestingly, you can also make, as Definitive does, bookshelf speakers and center channels with built-in powered subwoofers. The concept of a built-in powered subwoofer in the center channel is often misunderstood. It goes way beyond just putting more bass energy into the room: the intent is really to make the center channel a true full-range loudspeaker (i.e., one with extended bass capabilities) in order to give it total harmonic integrity, which is important for both music and home theater. Remember that in many movie mixes (*and some multichannel audio mixes —Ed.*), the center channel is really the main channel. Because of the logistics of setting up a home theater, the center channel normally has size limitations. Building in a powered subwoofer in effect allows the center channel to achieve the performance of a large full-range floor-standing tower. It can have much the same effect in bookshelf speakers. Building a subwoofer into smaller speakers allows the designer to put some of the performance of a large tower into moderately sized models.

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Definitive Technology SuperTowers are designed on the concept that bipolar driver arrays and built-in powered subwoofer technologies combine to bring more realistic and satisfying musical reproduction into all home-listening environments. Importantly, these design approaches yield products that offer many of the advantages of large, exotic, and expensive high-end loudspeakers, but that take up less space, and that can be built (and bought) for a fraction of the price. AV

Definitive Technology®
The Leader in High-Performance Loudspeakers®

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